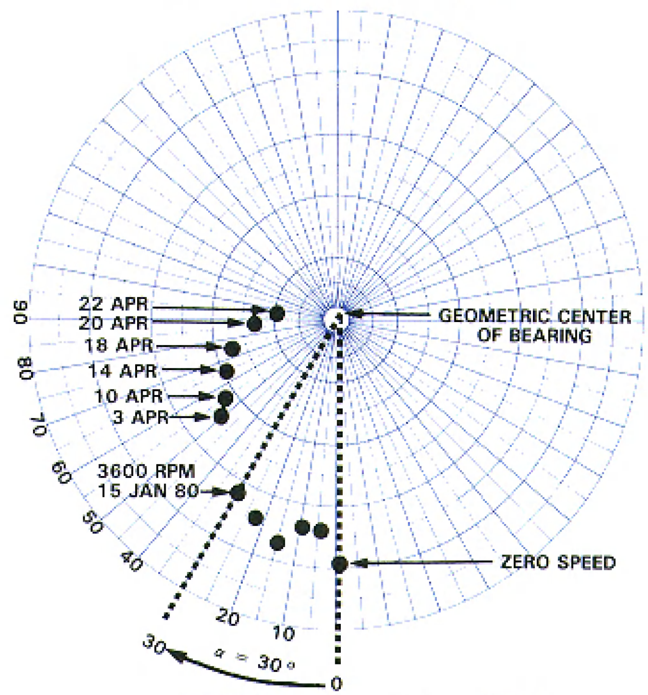
Machinery MESsages

Cure the machine of pnuemonia . . .

. . . and it dies of diptheria



The title of this column is a phrase often used by rotor experts. What the statement means is: Look at *all* the data, then determine *all* the potential characteristics of machine behavior which could produce such data. The potential always exists to identify only the obvious problem with a machine, to take action to correct that one problem, and then discover an underlying problem which is equally significant as the first problem.

In troubleshooting machinery, it is sometimes easy to make judgements about the obvious data, e.g. high 1X vibration means the rotor should be balanced, high 2X vibration means the alignment should be checked, etc. There are other considerations, however, such as aside from the large 1X component, what about that small ½X frequency? Or, what is causing the 350 Hz vibration, even though the amplitude is low?

Other considerations

If a machine exhibits high 1X and low ½X and you balance the rotor to reduce the 1X to an acceptably low level, closer scrutiny may reveal that the ½X was actually 47X and now the well-balanced rotor goes into full whirl.

Or maybe the high 1X is determined to be caused by excessive radial clearance, but upon reduction of the clearance (which also decreases the damping) the amplification factor is unacceptably high going through the first critical. The point is, the problem may not have been excessive bearing clearance at all.

Another "snake in the grass" to watch out for when analyzing data is this: If the data obviously indicates the presence of a certain problem, the correct action to be taken may not necessarily be a *direct* solution to that particular problem. A wise man once said, "Inside every small problem is a big problem struggling to get out."

Past machine performance

What appears to be the primary malfunction may only be the result of a different malfunction. In this situation it is not sufficient to observe only the behavior of the machine today. It is necessary to know what it was doing the previous shift, yesterday, and even last week or last month.

Today, most critical machinery is continuously monitored with permanently installed instrumentation systems. Some systems even include a recorder or data logger to provide trend information.

Obviously, any significant change in the trend dictates a closer inspection of the machine's mechanical condition. However, from a dynamics standpoint, most monitoring systems and trend data show vibration *amplitude* as the only continuously measured parameter. Certain significant problems can occur without an equally significant change in amplitude.

Survey machinery periodically

It is, therefore, highly desirable to survey machinery on a periodic basis even if the amplitude trend shows no change. Surveys should include other parameters such as vibration frequency, average shaft centerline radial position, vibration phase angle, time base waveforms, and orbits.

Admittedly, this may require a generous amount of time acquiring, documenting, and analyzing the data, as well as some capital expenditure, But today's microprocessor technology allows much of this work to be performed by machine, rather than man.

In many situations, the recognition of one significant problem (especially one which increases machine availability in the long run) can justify the time and effort required for the entire program.

Case history

A further explanation of these concepts, including a related case history, was presented in a recent paper by Ron Bosmans, Director of Mechanical Engineering Services for Bently Nevada. The paper, entitled "Detection and Early Diagnosis of Potential Failures of Rotating Machinery," was presented at the Joint ASME/IEEE Power Generation Conference, October 1981, in St. Louis, Missouri.

(continued on page 8)

Machinery MESages

(continued from page 7)

The case history shows that one machine problem can lead to another, and only through careful observation of *all* the data can the original problem be determined.

Here is an excerpt from the paper:

"The data shown (see figure on page 7) indicates that significant changes in shaft centerline motion began to occur from April 1-22, 1980. On April 22, 1980, the machine incurred an oil whirl condition on the #3 bearing . . . The increased amplitude from the oil whirl condition initiated a light rub within the machine . . . The light rub condition initiated athermal bowing of the rotor. This condition temporarily suppressed the oil whirl malfunction. However, the oil whirl condition manifested again later that same day. The subsequent high vibration caused a heavy impaction to occur. The increased system stiffness induced by the rub action raised the first critical to 1800 rpm. This exact integer relationship with the operating speed of 3600 rpm caused the first balance resonance to be re-excited . . . The re-excitation of the first balance resonance also caused the oil whirl instability to transform immediately into an oil whip malfunction."

Obviously, this was not a simple problem to recognize.

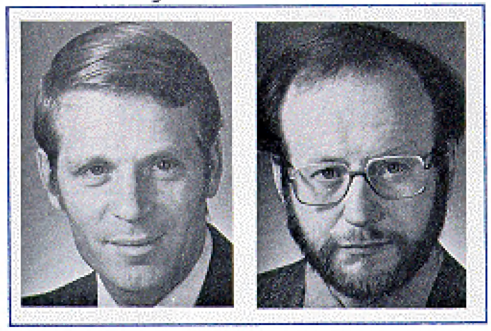
A copy of this paper is available from ASME by order number 81-JPGC-Pwr-28.

By Mark Gilstrap
Mechanical Engineering Services

At Your Service

Promotions and new faces

J. FARRELL LARSEN has joined Bently Nevada as a MES field engineer.



Larsen is based at the Southern California office in Irvine.

He was formerly employed by Solar Turbines fór eight years where he held numerous positions including development engineer, project engineer, and quality engineer. Larsen also performed engineering duties as a civil servant for the U. S. Navy Mechanical Engineer Equipment Management Group.

Larsen earned a Bachelor of Science Degree in Mechanical Engineering from California State Polytechnic College. He also received a Master of Science Degree in Systems Management from the University of Southern California.

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TIM GROTH has assumed the position of Domestic Product Service Manager.

He has been primarily involved in the marketing and design of Bently Nevada's computer systems and computer interface equipment since joining the company in 1979. Groth held the positions of Product Manager and Engineer III before being promoted to his present position.

ANTHONY G. TAYLOR has been named MES field engineer of our Edmonton, Canada office.

A registered engineer, Taylor has worked in the aircraft industry in Canada and the United Kingdom performing vibration and flutter analysis. He also was employed by the Ontario Ministry of Environment dealing with accoustic noise control and by Ontario Hydro where he performed rotor dynamics on power generation machinery.

Taylor earned a Bachelor Degree in Mechanical Engineering from the University of Sheffield, England. He received his Masters Degree from the University of Toronto, Canada.

★

WILLIAM "BILL" CLASEN was named district sales manager of Bently Nevada's San Francisco office located in Dublin, California.

Employed by Bently Nevada for four years, Clasen served as a sales representative at Bently Nevada's Irvine office prior to assuming his present duties. He also worked as customer service manager and in Bently Nevada's applications engineering group.

Around the World

Seminars conducted in China

Carl Spahr with students.

Bently Nevada conducted seminars and meetings in China last fall at the invitation of the Chinese Council for the Promotion of International Trade.

The cities visited were Beijing, Harbin, Shenyang, Chang Chun, Shanghai, Hangzhou, Wuxi, and several other provinces.

Power generation is a top Chinese priority. The seminars and meetings dealt with applying vibration monitoring to power generation machinery. Topics included probe and Proximitor theory, the use of Bently Nevada diagnostic instruments, filters, plotting, and balancing. Predictive and preventive maintenance programs were also covered.

The Chinese most often use case mounted velocity pickups and shaft riders to monitor rotating machinery. China manufactures its own velocity pickups.

The Chinese, eager to learn about new technologies, expressed particular interest in learning balancing techniques, machine behavior and analysis techniques, and predictive and preventive maintenance.

By Carl Spahr